

Prüfbericht-Nr.: Test report no.:	ULR-TC568821300000090F	Auftrags-Nr.: Order no.:	166571640 0020	Seite 1 von 19 Page 1 of 19
Kunden-Referenz-Nr.: Client reference no.:	2115186	Auftragsdatum: Order date:	2020.11.27	
Auftraggeber: Client:	Minda Corporation Limited D6-11, Sector-59, Noida – 201301 (Uttar Pradesh)			
Prüfgegenstand: Test item:	Electronic Kit Keyless System			
Bezeichnung: Identification .:	SUPERVISORY CONTROL UNIT(SCU)			
Auftrags-Inhalt: Order content:	Testing and issue of Test Report and Grant Certificate			
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C 15.205 ,15.209 / ICES-003 Issue 6			
Wareneingangsdatum: Date of sample receipt:	2021.09.03			
Prüfmuster-Nr & Serien-Nr.: Test sample no & serial no.:	A003122697-001 A003122697-002 & SCU(EC-360001A) & FOB(ER-365001A)			
Prüfzeitraum: Testing period:	2021.09.03 - 2021.09.21			
Ort der Prüfung: Place of testing:	Wireless laboratory, Bangalore			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Bangalore-560100, India FCC Test Site Registration No: 496599 ISED Test Site Registration No.: 3466E-1			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date: 2021.09.03		Ausstellatum: Issue date: 2021.11.04		
Stellung / Position:	M.V.Naveen Kumar Engineer	Stellung / Position:	Mahammadgouse Kaladagi Assistant Manager	
Sonstiges / Other:	FCC ID: 2A29L-360001A			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet 5 = poor N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568821300000090F

Seite 2 von 19

Page 2 of 19

TEST SUMMARY

Test Item	FCC	ISED	Result
Restricted Bands of Operation	15.205	RSS Gen Issue 4, RSS 210 Issue 9	Pass
Spurious Radiated emission	15.209	RSS Gen Issue 4, RSS 210 Issue 9	Pass

Note:

1. The Product Electronic kit wireless system has 2 separate parts namely as Supervisory Control Unit (SCU) and Key Fob. SCU part has 125 KHz LF Transmitter and 315MHz RF Receiver. And Key Fob part has 315MHz RF Transmitter and 125 KHz Receiver.
2. This Test report covers the SCU section 125 KHz Transmitters test cases
3. This device Transmits LF Transmitter (125 kHz) hence conducted test cases not performed.
4. Transmitter test cases for UHF Frequency (315 MHz) by KEYFOB please refer the test report number (ULR-TC568821300000089F) issued by TUV Rheinland India Pvt Ltd.

Discipline: Electronics Testing

Group: EMC Test Facility

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568821300000090F

Seite 3 von 19

Page 3 of 19

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568821300000090F	01	Testing & Issue of Test report	2021.11.04

Table of Contents

1	GENERAL REMARKS	5
1.1	Attachments	5
2	TEST SITES	6
2.1	Testing Facilities.....	6
2.2	List of Test and Measurement Instruments.....	6
3	GENERAL PRODUCT INFORMATION.....	7
3.1	Product Function and Intended Use.....	7
3.2	Ratings and System Details	7
3.3	Measurement Uncertainty:	8
4	TEST SET-UP AND OPERATION MODE.....	9
4.1	Principle of Configuration Selection	9
4.2	Operation and Software of the EUT	9
4.3	Test Modes – data rates and modulation.....	9
4.4	Special Accessories and Auxiliary Equipment	9
4.5	Countermeasures to achieve EMC Compliance	9
4.6	Report Reference	9
4.7	Sample identification	9
5	Operational Description	10
6	Block Diagram.....	10
7	TEST METHODOLOGY	11
7.1	Radiated Emission Test	11
7.1.1	Test Setup Configuration	11
8	Spurious Radiated Emissions & Restricted Bands of Operation	13
9	LIST OF TABLES.....	19
10	LIST OF FIGURES.....	19

1 GENERAL REMARKS

1.1 Attachments

All attachments are part of this test report and are issued in separate document

1. TEST SETUP PHOTOS
- 2: EUT EXTERNAL PHOTOS
- 3: EUT INTERNAL PHOTOS
- 4: FCC LABEL AND LABEL LOCATION
- 5: BLOCK DIAGRAM
- 6: SPECIFICATION OF EUT
- 7: SCHEMATIC DIAGRAM
- 8: BILL OF MATERIAL
- 9: USER MANUAL

Prüfbericht - Nr.:

ULR-TC568821300000090F

Seite 6 von 19

Test Report No.:

Page 6 of 19

2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Private Limited
108, Beside ISBR Business School,
Electronic City Phase 1,
Bangalore – 560 100.
India

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
EMI Receiver	Rohde & Schwarz	ESW 44	101732	4.73 SP5	19.05.2022	Yearly	Radiated Spurious Emission
Active loop antenna	Schwarzbeck	FMZB 1519 B	1519B-00111	-	27.04.2022	Yearly	
Balun & Biconical Antenna	Schwarzbeck Mess-Elektronik	BBA 9106+V HBB 9124	9124-1117	-	25.02.2022	Balun & Biconical Antenna	
Log - Periodical Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	24.02.2022	Log - Periodical Antenna	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Signal Analyser	Rohde & Schwarz	FSV7	1321.300 8K07/101 644	3.40	15.01.2022	Yearly	Antenna port Measurement

Table 2: Instrument application Software versions

Sl. No	Test Type	Application software	Version
1	Radiated spurious emission measurement- 3 meter Fully Anechoic Chamber	EMC 32	10.60.00
2	Radiated spurious emission measurement in SAC	BAT EMC	3.20.0.17

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

Smart Control Unit Features

- Operates All the Four Turn Indicators and Indication Sign on Instrument Cluster when finder request is received from FOB
- Retracts solenoid to allow the lock bar to operate (If authorized user press the knob switch on the vehicle)
- Operates Seat Actuator when Seat switch is pressed from Vehicle or from FOB
- Operates the LED & Immo LED as per pattern mentioned in SR
- Operates FT Actuator when FT switch is pressed from Vehicle or from FOB
- Communicates with Engine ECU (If authentication successful)
- Transmits LF signals (125 KHz) to wake up and request authentication data from FOB (When Knob switch is pressed on vehicle)
- Receives & demodulates the UHF signals (315MHz) to authenticate the key FOB.

FOB Assembly Features

- Switching ON/OFF Smart communication feature using a switch
- Answer Back, Seat Open, FT open operation using a switch
- Senses LF Signal (125KHz)
- Transmits RF Signal (315MHz)
- Measures the strength(RSSI) of the LF signal

3.2 Ratings and System Details

Table 3: Ratings and System Details as declared by the client

RF Transmitter		RFID(125kHz)
Operating Frequency Range		125kHz(Single Frequency)
No. of Channels		1
Modulation		AM
Number of antennas		1
Antenna Type		LF Antenna
Antenna Gain		Approximately (-70dBi)
Supply Voltage to product		12VDC through DC Power supply
Environmental conditions	Storage	-30°C to +85°C
	Operating	-30°C to +80°C
EUT Dimension(L x B x H) in mm		L(92) x B(91.6) x H(37) in mm

***Disclaimer:**

The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details.

3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$

Table 4: Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1.5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
FAC, radiated measurement	$\pm 6 \text{ dB}$
Temperature	$\pm 3 \text{ }^{\circ}\text{C}$
Supply Voltages	$\pm 3 \%$
Time	$\pm 5 \%$

Note: The Listed Measurement Uncertainties are the worst-case uncertainty, for the respective test cases. Above Table is for reporting purpose only and not used in determining Final Pass/Fail verdict.

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle on single frequency.

4.2 Operation and Software of the EUT

Software Name & Version SCU : SMIT_VAS_030_20_Piaggio_Smart_Key_SW_V0_7_TLck_All_In_One.hex

Software Name & Version FOB : SMIT_VAS_030_20_Smart_Key_System_FOB_V0.2.bat

Hardware Name & Version SCU : SMIT_VAS_030_20_V1.0

Hardware Name & Version FOB : AT_400008_F-V1.4

4.3 Test Modes – data rates and modulation

This device having 125kHz of LF Transmitter and 315MHz of RF Receiver

4.4 Special Accessories and Auxiliary Equipment

None

4.5 Countermeasures to achieve EMC Compliance

None

4.6 Report Reference

The Product Electronic kit wireless system has 2 separate parts namely as Supervisory Control Unit(SCU) and Key Fob. SCU part has 125 KHz LF Transmitter and 315MHz RF Receiver. And Key Fob part has 315MHz RF Transmitter and 125 KHz Receiver.

Product Name	Test Report Number
SUPERVISORY CONTROL UNIT	This Report
KeyFOB	ULR-TC568821300000089F

4.7 Sample identification

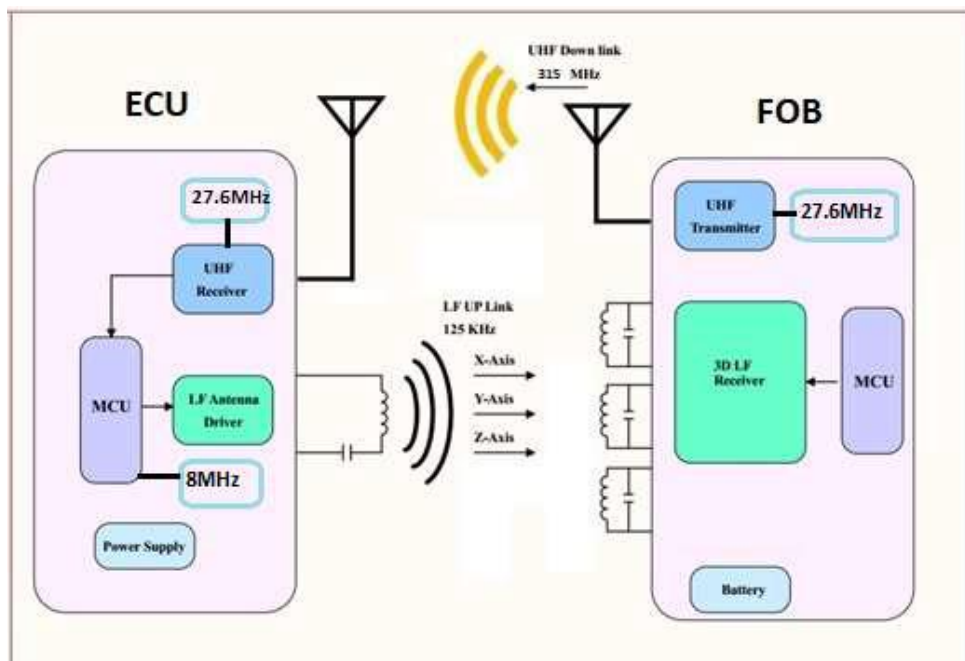
TUV Sample Identification number : A003122697-001 → Conducted Sample

A003122697-002 → Radiated Sample

5 Operational Description

This product is applicable for the LOCK / UNLOCKS operation of the handle lock when authorized user (with key FOB) within distance of 1.5 meter distance. Authorized user can open the fuel cap and seat from vehicle within distance of 1.5 meter distance. In addition it has a vehicle locator finder, seat, FT open function from the FOB when authorized user (with key FOB) within distance of 50 meter from the vehicle. Vehicle finder indication take place over the flasher. ECU is communicating with Engine ECU over the CAN for the status of authentication & DTC. LED and IMMO LED provided on dashboard for the indication of authentication status. The developed system suitable for two wheelers for the smart key system.

6 Block Diagram



7 TEST METHODOLOGY

7.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.4-2014. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, The measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Baloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded.

7.1.1 Test Setup Configuration

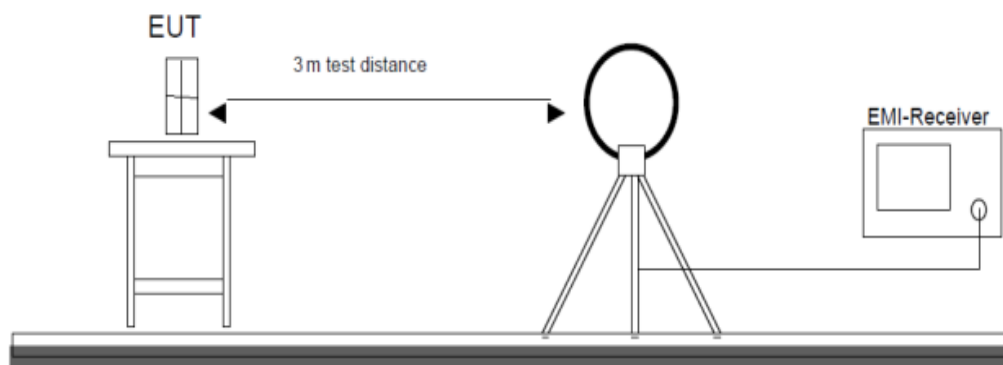


Figure 1: Frequency Range 9 kHz- 30 MHz

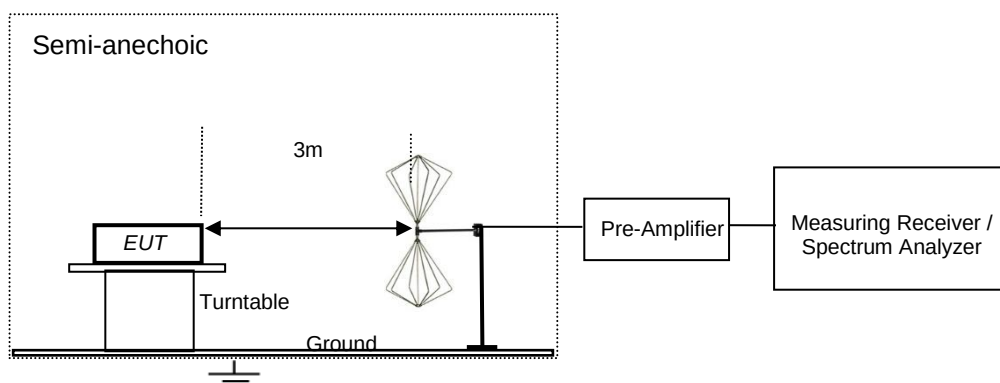


Figure 2: Frequency Range 30 MHz – 200 MHz

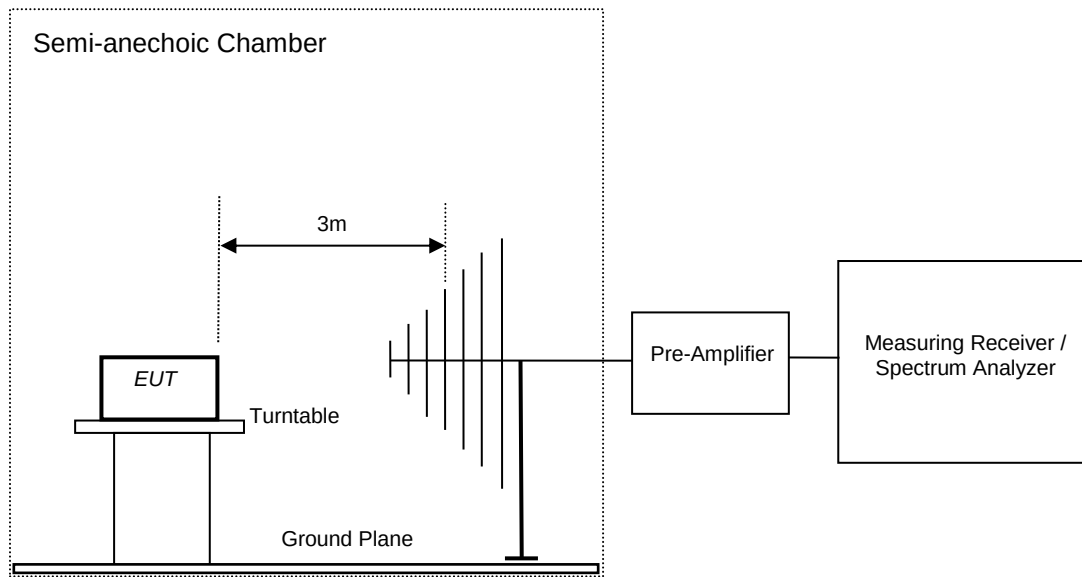


Figure 3: Frequency Range 200 MHz - 1GHz

8 Spurious Radiated Emissions & Restricted Bands of Operation

Result **Pass**

Test Specification	FCC part 15 Subpart C 15.205(a), 15.209(a) RSS 210, Section 4.3 with RSS-Gen, Sections 8.10 and 8.9
Test Method	ANSI C63.10-2013
Measurement Location	Semi Anechoic Chamber 9kHz - 1 GHz
Measurement Bandwidth	200Hz for frequency range < 150kHz 9kHz for frequency range < 30MHz 100kHz for frequency range of < 1GHz
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 5: Transmitter Field strength Limits

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Conditions:

Temperature (Norm) = + 24 °C
Voltage = powered by SCU (powered by DC 12VDC)
Relative humidity = 62 %

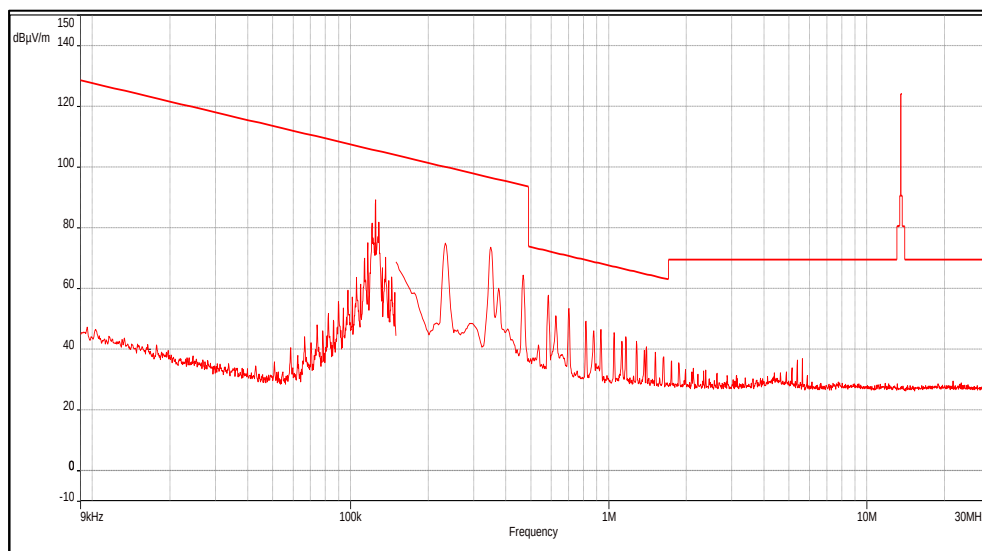
Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

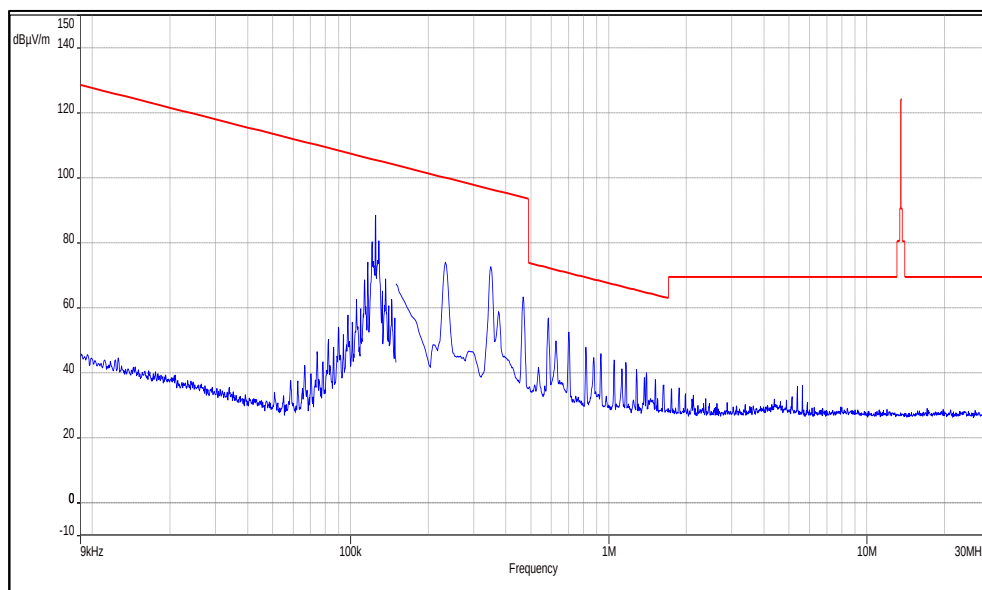
EUT in Transmit Mode

Transmitter Spurious Emissions in the frequency range 9 KHz – 30 MHz

Polarization	Measured Frequency (MHz)	Measured peak Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Parallel	0.584	57.72	72.27	-14.55
Perpendicular	0.584	56.85	72.27	-15.42



Polarization: Parallel



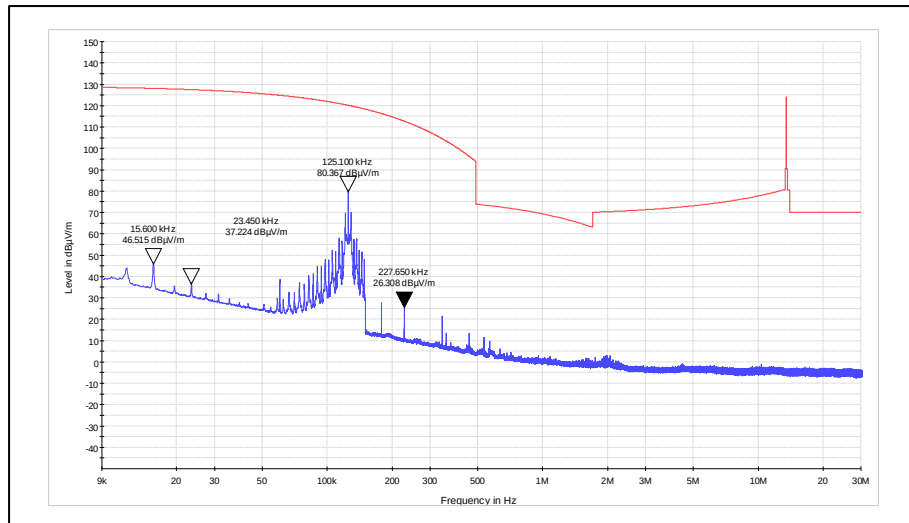
Polarization: Perpendicular

Polarization	Measured Frequency (kHz)	Measured Peak value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Parallel	15.60	46.51	123.74	-77.23
	23.45	37.22	120.20	-82.98
	125.10	80.36	-	*
	227.65	26.30	100.45	-74.15
Perpendicular	60.35	38.75	111.99	-73.24
	109.50	49.19	106.81	-57.62
	125.10	77.71	-	*
	178.30	43.46	102.58	-59.12
	375.35	41.95	96.11	-54.16

Note:

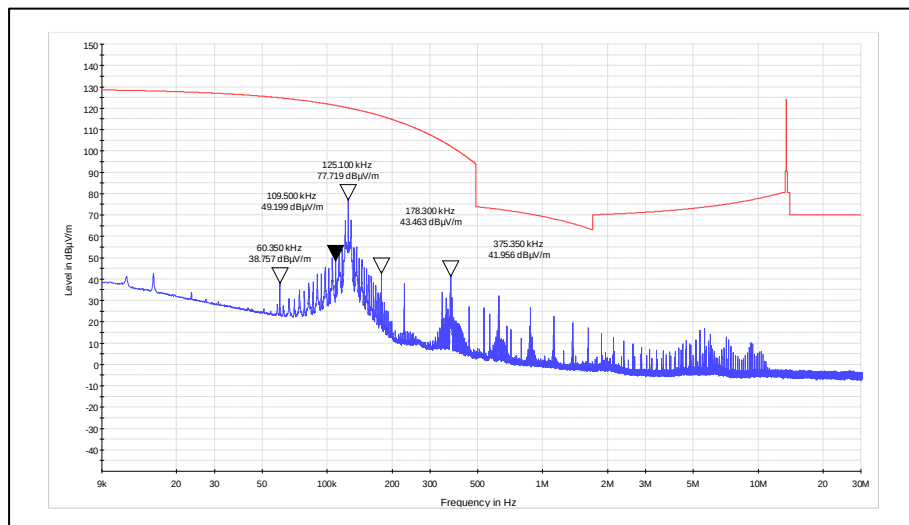
Linear interpolation of Limit $\rightarrow 20 \cdot \log(2400/F) + 40 \cdot \log(300/3)$

-* indicates Nominal Frequency (125kHz)



Frequency range: 9kHz to 30MHz

Polarization: Parallel



Frequency range: 9kHz to 30MHz

Polarization: Perpendicular

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568821300000090F

Seite 16 von 19

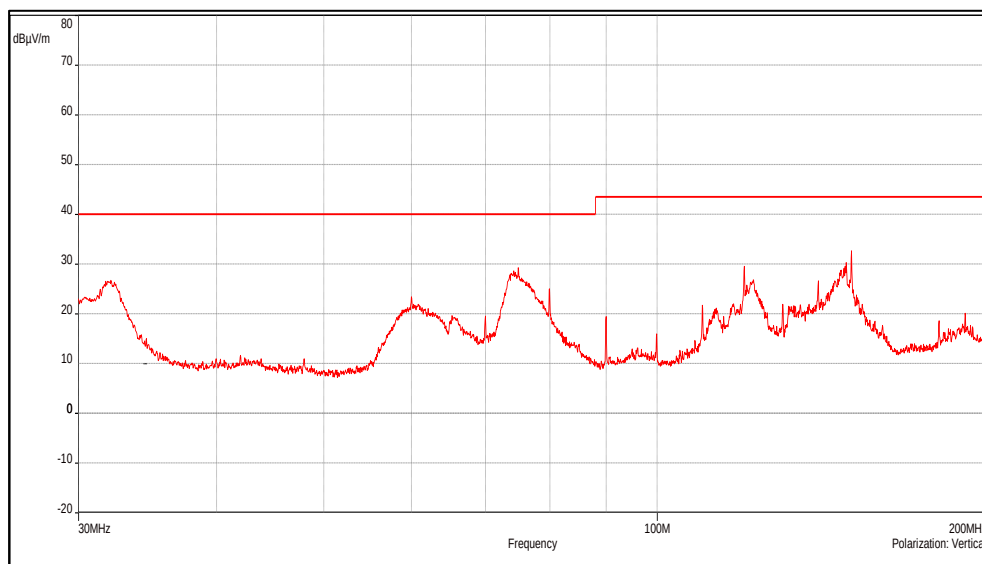
Page 16 of 19

Transmitter Spurious Emissions in the frequency range 30 MHz – 1 GHz

Polarization	Measured Frequency (MHz)	Measured peak Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	32.10	26.68	40.00	-13.32
	60.00	23.41	40.00	-16.59
	74.94	29.22	40.00	-10.78
	119.94	29.53	43.50	-13.97
	149.88	32.68	43.50	-10.82
	239.81	23.69	46.00	-22.31
	369.71	21.30	46.00	-24.70
	469.61	22.22	46.00	-23.78
	649.46	26.35	46.00	-19.65
	942.71	30.05	46.00	-15.95
Horizontal	32.10	14.86	40.00	-25.14
	74.94	16.53	40.00	-23.47
	109.95	19.41	43.50	-24.09
	119.91	21.59	43.50	-21.91
	149.88	25.73	43.50	-17.77
	239.81	22.38	46.00	-23.62
	339.74	22.71	46.00	-23.29
	649.49	25.91	46.00	-20.09
	779.39	29.46	46.00	-16.54
	896.15	32.60	46.00	-13.40

Test Plots:

Frequency range: 30MHz – 200MHz



Frequency Range: 30MHz – 200MHz

Polarization: Vertical

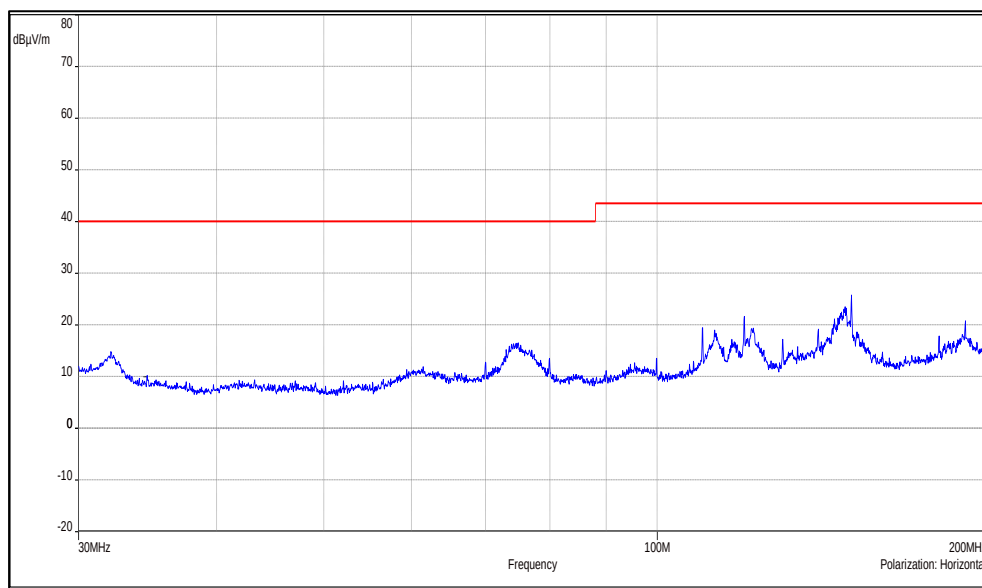
Prüfbericht - Nr.:

ULR-TC568821300000090F

Seite 17 von 19

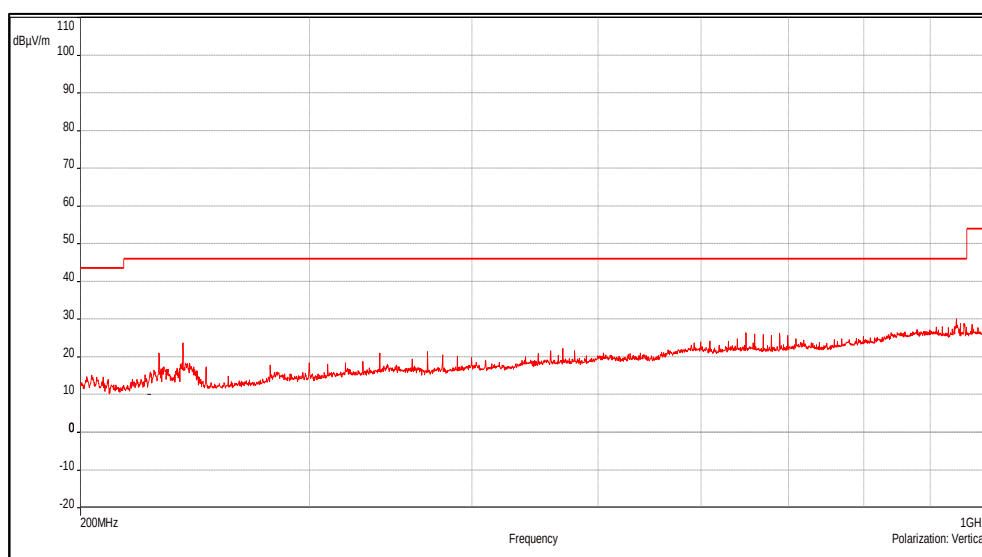
Test Report No.:

Page 17 of 19



Frequency Range: 30MHz – 200MHz

Polarization: Horizontal



Frequency Range: 200MHz – 1GHz

Polarization: Vertical

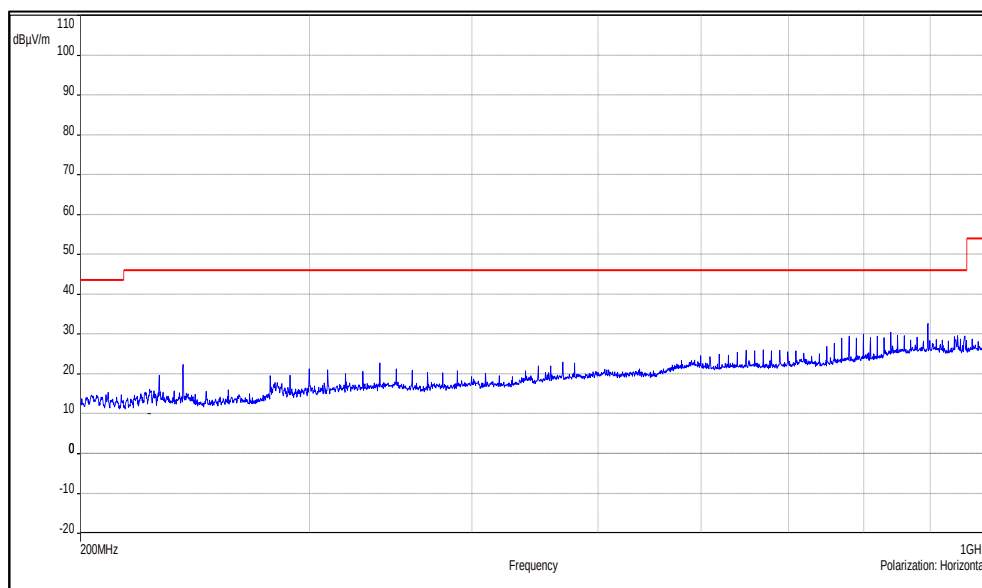
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568821300000090F

Seite 18 von 19

Page 18 of 19



Frequency Range: 200MHz – 1GHz

Polarization: Horizontal

9 LIST OF TABLES

Table 1: List of test and measurement instruments	6
Table 2: Instrument application Software versions	6
Table 3: Ratings and System Details as declared by the client	7
Table 4: Measurement Uncertainty	8
Table 5: Transmitter Field strength Limits.....	13

10 LIST OF FIGURES

Figure 1: Frequency Range 9 kHz- 30 MHz	11
Figure 2: Frequency Range 30 MHz – 200 MHz	11
Figure 3: Frequency Range 200 MHz - 1GHz	12

*****END OF TEST REPORT*****